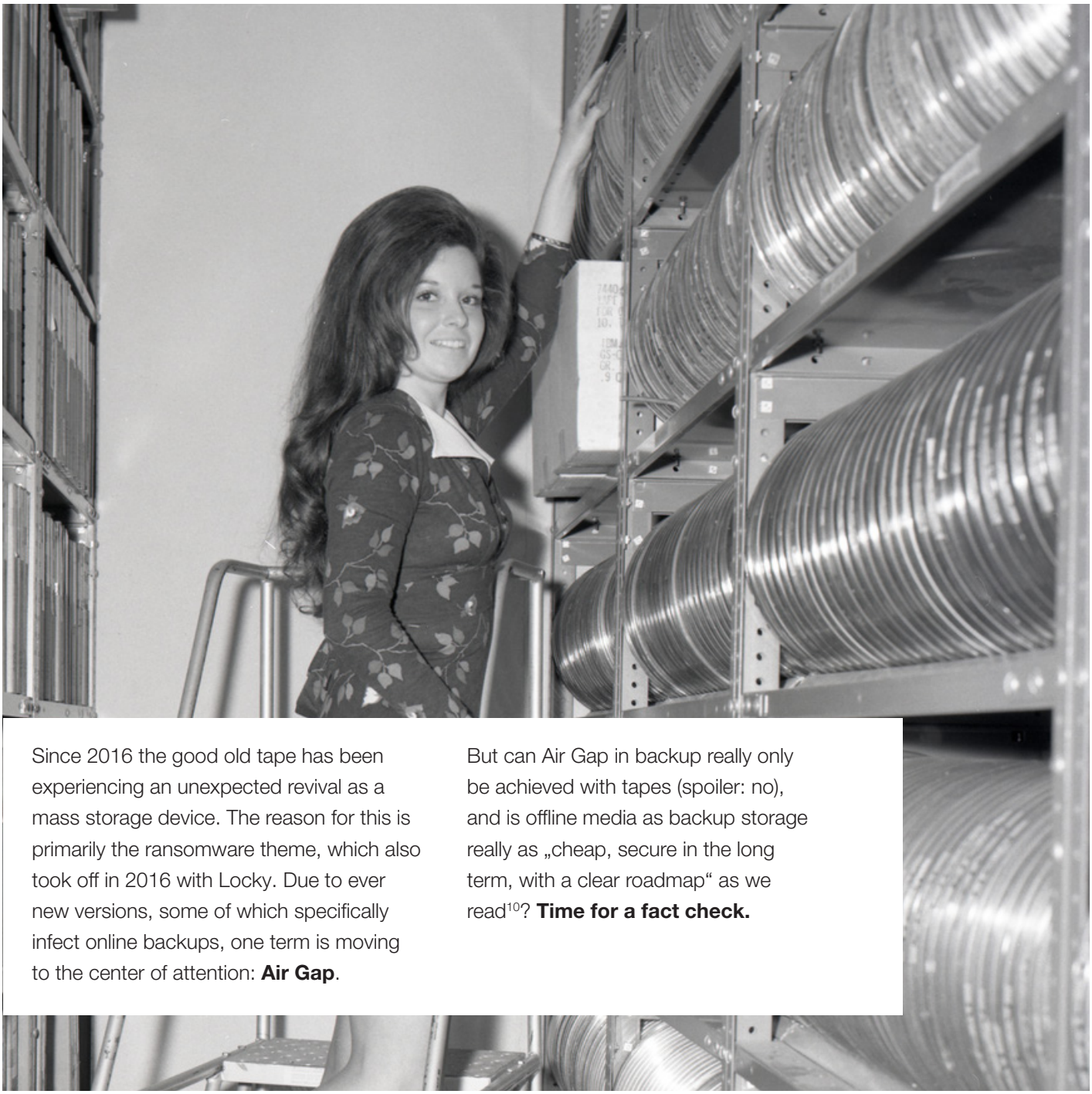
FAST LTA
We secure Petabytes.

?!

FACT CHECK

Backup with Tapes



Since 2016 the good old tape has been experiencing an unexpected revival as a mass storage device. The reason for this is primarily the ransomware theme, which also took off in 2016 with Locky. Due to ever new versions, some of which specifically infect online backups, one term is moving to the center of attention: **Air Gap**.

But can Air Gap in backup really only be achieved with tapes (spoiler: no), and is offline media as backup storage really as „cheap, secure in the long term, with a clear roadmap“ as we read[10]? **Time for a fact check.**

Photo: The U.S. National Archives (1974)

#1

“Tapes are durable and secure”

LTO tapes are actually physically quite robust data carriers, which basically have a wide range of applications in terms of temperature and humidity. This must be the case, since tapes were developed purely as offline media to be removable and transportable.

However, tapes are increasingly susceptible to contamination and other physical damage, since an LTO-8 tape is now three times as long and half as thick (thin) as the first generation at around 1 km in length and 5.6 µm in thickness - and offers around five times the data density[1]. Without doubt a masterpiece of engineering.

As Fujifilm describes in a support document[2], long-term storage is only conceivable if precise conditions are met, namely 18°C (+/- 2°C) and 20-50% relative humidity (+/- 5%). To avoid contamination, tapes must also always be transported and stored in special boxes and drives must be regularly operated with cleaning tapes.

Another important component for protection against data failure is integrated data protection, which HDD and flash-based storage systems typically achieve via redundancy coding (RAID, or the more modern Erasure Coding). Tapes as a purely linear medium naturally lack this completely, so that the protection against defects must be done via copies - a time-consuming process which of course also multiplies the costs.

A backup is only as safe as a successful restore - and here, too, it is important to take a closer look. Although the famous 71% “failed restores of tape” are made up from an alleged Gartner study[3], Storage Magazine, for example, reports that about a third of respondents said that the unreliability of tape was often or sometimes a significant problem that made backups unusable[4]. A study commissioned by Acronis even states that 75% of the IT admins surveyed had problems with tapes within a year[5].

This is particularly critical, since tapes are only reasonably reliable when used rarely and properly. Properly, with regard to the purely linear offline medium, means: Reading only in the stream, i.e. large, coherent data volumes. However, if a media error occurs, the restore is usually aborted and completely unusable. The problem is exacerbated by the large amounts of data that now fit onto a

FUJIFILM

Usage & Storage environments for LTO/3592

Condition	Temperature	Humidity	Magnetic Field
Usage – Drive Environment	10°- 45° C (50° - 113° F)	10 - 80% RH (max wet-bulb temp – 26° C)	
Short & Medium Term Storage	16°-35° C (61° -95° F) ± 2° C	20 – 80% RH ± 5% RH (max wet-bulb temp – 26° C)	4000 A/m (50 Oe) or less *
Long-term Storage	Ideal 18° C (65° F) ± 2° C 16-27C (61 -80F)	20 – 50% RH ± 5% RH (max wet-bulb temp – 26° C)	4000 A/m (50 Oe) or less *

* As magnetic fields dissipate quickly, ensuring tapes are at least 10cm (4") from any possible magnetic source will minimize the chance of any accidental tape erasure.

Image: Fujifilm

single tape - up to 12 TB (uncompressed, LTO-8). If such a tape is completely unusable, this affects an immense amount of stored information. Tape is unsuitable for restoring individual data (sets) anyway. A magnetic tape suffers extremely when it is rewound back and forth and the rotating read head is constantly repositioned ("Shoe Shining").

CHECK

While tapes offer "read-after-write" problem detection immediately after writing, tapes do not offer built-in security and must be checked regularly. Redundancy is only possible by copying, which multiplies effort and costs. Tapes are only reliable with minimal use and only when reading large amounts of data in a continuous process. Long-term operation over ten or more years requires frequent migration to new generations and correspondingly long maintenance contracts for the infrastructure.

COUNTERCHECK

Storage systems for backup based on hard disks (or flash) offer higher security with redundancy coding and other protective measures, without losing flexibility through random access. This increased security protects such systems from losing data for years. The mechanical component is very small. In the Silent Brick System, Erasure Coding with linear file system (which nevertheless offers random access when reading) and Continuous Snapshots provide additional security against manipulation or deletion, e.g. by ransomware. The Silent Brick storage media are robust and well protected against environmental influences. Maintenance contracts for 10 and more years at the same costs are offered.

#2

“There is a clearly defined roadmap for LTO”

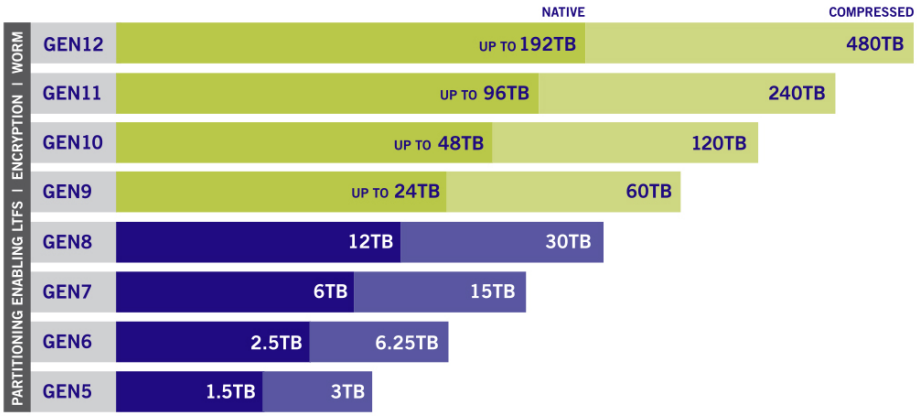
From the very beginning, two premises were made in the development of LTO: the data capacity should double every 2 years, and drives of a new generation should be able to read tapes that are at least 2 generations behind. An LTO-6 drive can therefore read and write LTO-6 and LTO-5 tapes, and read LTO-4 tapes. So a migration in a reasonable range (4-6 years) is necessary and possible[6].

These specifications were more or less valid until LTO-7, even if the 2 years since LTO-4 are no longer sustainable. In the meantime, LTO-8 has reached 12 TB, 120 times more than the original 100 GB. What happened with the introduction of LTO-8 seems to be more difficult: Due to a patent dispute between Fujifilm and SONY there was no media to buy for almost half a year.

In September 2019, the dispute was settled, but LTO-8 now deviates significantly from the second specification. LTO-8 drives cannot read LTO-6 media at all. The backward compatibility has shrunk to one generation.

What doesn’t sound very decisive at first sight, has already effects. Since 2016 (LTO-5), the number of media sold has increased significantly, which means that users will either have to migrate more often (with the corresponding costs and effort), or continue to operate old drives, which usually results in a costly extension of existing maintenance contracts.

LTO ULTRIUM ROADMAP
ADDRESSING YOUR STORAGE NEEDS



NOTE: Compressed capacity for generation 5 assumes 2:1 compression. Compressed capacities for generations 6-12 assume 2.5:1 compression (achieved with larger compression history buffer).
SOURCE: The LTO Program. The LTO Ultrium roadmap is subject to change without notice and represents goals and objectives only. Linear Tape-Open, LTO, the LTO logo, Ultrium, and the Ultrium logo are registered trademarks of Hewlett Packard Enterprise, IBM and Quantum in the US and other countries.

Image: lto.org

CHECK

The roadmap of the LTO consortium is intended to provide planning security for the user, but only applies with certain limitations. The current generation LTO-8 has several problems. A roadmap that is not followed is not worth much.

COUNTERCHECK

Hard disk drive manufacturers do not have a public roadmap, but they also do not need a consortium to meet industry-wide standards and thus enable deployment in virtually every area of IT. Capacities for both hard disks and flash memory are increasing at least as fast as for tapes[7]. The customer benefits from the wide choice and innovation of manufacturers who are not bound to a fixed roadmap. For example, up to 24 TB per storage unit are available for the Silent Brick (portable), while the Silent Brick DS (stationary) currently offers up to 192 TB per height unit.

#3

“Tapes are inexpensive”

This assertion can hardly be refuted: an LTO-8 tape can be bought for a good 100€ at present. A single consumer hard disk (12 TB) costs almost three times as much at just under 300€, SSDs of this size are not offered (8 TB cost about 800€, which would mean at least 1200€ for 12 TB).

However, tape is only used in modern backup as a pure offline medium for regular outsourcing of full backups. If hard disk or even flash arrays were to be used for this purpose, without changing the backup concept, the costs would increase many times over. However, modern backup concepts make it possible to significantly reduce the number of outsourced full backups and to use existing flash or disk infrastructure more than once and more efficiently. Since tape as an offline medium is not suitable for incremental backups, InstantRecovery® instances or file server backups anyway, one measure in particular saves money: to do without the additional tape infrastructure.

Modern storage systems scale dynamically and allow different configurations for different aspects of a backup concept. VTL configuration also allows areas where tape was previously used to be immediately integrated into the system - in a second step, most tape-specific scenarios can then be replaced by modern variants.

Tape is therefore only really cost-effective where the lowest cost per TB without any active use is the only thing that counts: in large archives in the multi-digit petabyte range. This is also reflected in the fact that the TCO calculator on the LTO consortium’s website is designed exclusively for archive applications[8].

Image: idealo.de, as of September 1st 2020

CHECK

If you only consider the cost per TB, tape is indeed unbeatably cheap. However, tape storage as a pure offline media has an extremely limited range of use and is unsuitable for 3 of the 4 components of modern backups. If tape is only used as an offline medium in a backup infrastructure that is otherwise based on flash and hard disks, high costs for investment, operation and maintenance of the drives are also incurred.

COUNTERCHECK

Since the Silent Bricks provide an offline-capable storage medium with higher integrated security and higher capacity, and at the same time fit into the rest of the infrastructure for modern backups at no additional cost, the biggest lever to save costs in backup is to do without tape. Modern, integrated backup concepts require far fewer full backups that can be outsourced and yet offer higher security against ransomware.

#4

“Air Gap only works with tape”

Air Gap is the social distancing of IT. What has no contact cannot be infected. So offline-capable media are needed that can store large amounts of data and are secure within themselves.

Conventional hard disk storage is not suitable for this. Enterprise hard disks must not be disconnected from the power in the first place, and anyone who has ever had to carry a large RAID system knows that this is not the point. Single, external media (flash, hard drives, etc.) are not on the level that professional users need, and handling is usually not covered by the appropriate backup software.

So are there really only tapes left?

Tapes are transportable as pure offline media and were developed for professional use. Due to their linearity, they at least offer a minimum of integrated data security, and the media is also inexpensive. Tapes are a good choice if you focus on the capabilities that an air-gap medium absolutely must have.

But it is not the only one.

As strange as it may sound, cloud-based storage can also be a good alternative, for example. Since full backups on tapes are often “misused” as archives anyway, online archive services like Amazon Glacier can also be used. These also offer the possibility of permanently protecting the data against overwriting using WORM, and the provider also takes care of further protection against data loss. If one assumes that the data will never be needed again anyway, the comparatively high transfer costs are not significant.

However, it remains to be seen what a data storage device is used for, which one would prefer never to access again.

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„According to W. Curtis Preston, analyst at Storage Switzerland, only physical air gaps, i.e. tape, offer almost complete security.[9]

Alternatives also exist on hard disk basis. With RDX there is a successor of the JAZ drives popular in the 1990s. Robust, mobile data carriers are supposed to replace tapes 1:1, but just like these, they do without integrated data backup and thus offer hardly any advantages over conventional external hard disks.

FAST LTA's Silent Bricks represent a secure alternative. These storage containers are part of the slot-based Silent Brick System, are transportable just like tapes and are very robust due to the use of conventional 2.5-inch hard drives (or SSDs) and a stable aluminum frame. They are larger and heavier than tapes, but already offer twice the capacity (up to 24 TB) and significantly higher security due to integrated redundancy (up to quadruple, ZFS or Erasure Coding), possible linearity (special file system with Erasure Coding) and optional WORM sealing. And they allow full random access when reading and can be reused several times without significant wear and tear.

CHECK ?

As pure offline media, tapes are inherently air-gap-capable and thus suitable for access-secure outsourcing of data.

COUNTERCHECK !

Silent Bricks are designed to be both online and offline transportable storage devices and are therefore 100% air-gap capable. Unlike tapes, silent bricks are part of an overall concept for all aspects of backup and archiving. Each Silent Brick, which is also available in a stationary version, can be individually configured and tailored to the specific aspect of the application. It can even be used as a “tape” by means of VTL, making direct replacement very easy.

#5

“Backup only works with tape”

“No truly resilient backup and disaster recovery strategy works without tape.”[7]

Dr. Jakob Jung
Journalist, Editorial office Cofa-Info

If one agrees with thesis #4, this is also true. However, the correct statement would be: “No really resilient backup and disaster recovery strategy works without Air Gap.

If you leave out tapes for Air Gap or replace them e.g. with Silent Bricks, the opposite is true: backup works very well without tapes. Since in this case a large technology block is omitted, which generates additional costs through investment, maintenance, operation and migration, the total cost of ownership (TCO) for implementing a modern backup strategy is generally even lower than with tapes - with higher security and greater flexibility.

Tapes are not dead - they still have a right to exist in applications where, in the case of very large data volumes, only the marginal storage costs are important and, ideally, the data should never have to be accessed again. Tapes are therefore suitable for very large archives with capacities in the multi-digit petabyte range, which can be operated with corresponding effort. The smaller the data volumes and the more important the possibility of data access, the less sensible it is to use tape.

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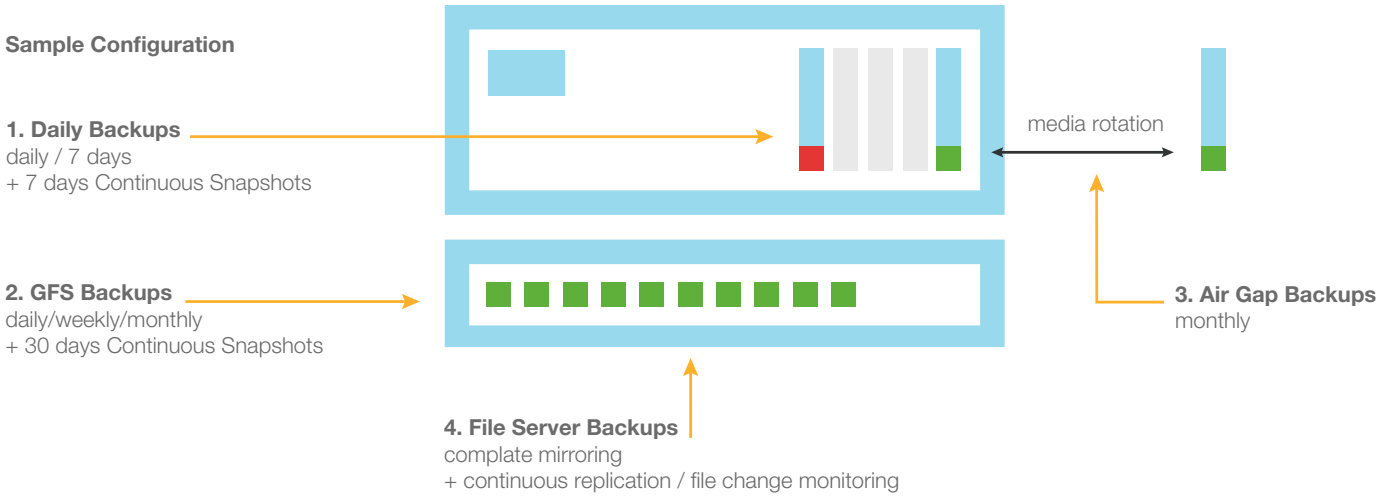

CHECK

Tapes can be part of a backup concept, but only cover a small aspect of it. In the archive area, tapes are only useful for very large data volumes that are hardly accessed at all.

COUNTERCHECK

Silent Bricks is a storage system for backup and archiving that combines all aspects of modern secondary data storage in one system - including physical air gap. By eliminating the need to connect, operate, maintain and migrate data from different systems, the overall costs are generally lower than with highly heterogeneous storage concepts.

Modern backup: Air Gap with Silent Bricks

Modern backup cannot do without Air Gap - but it can do without tapes. With the Silent Brick System there is a storage solution for all data protection requirements - archiving, backup and file server.

The Silent Bricks, the actual storage units, are available in a stationary version (Silent Brick DS) or as removable media that can be transported and used offline (Silent Brick and Silent Brick Flash). Due to the individual configurability per Silent Brick, all scenarios of modern data backup, including air gap with media rotation and even hardware WORM sealing, can be realized.

Silent Brick Controller with 1x Silent Brick Flash and 1x Silent Brick, below Silent Brick DS

next to it 1x Silent Brick (offline)

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